What is the relationship between alcohol intake and weight gain?

Conclusion

Moderate evidence suggests that among free-living populations, moderate drinking is not associated with weight gain. However, heavier consumption over time is associated with weight gain.

Grade: Moderate

Overall strength of the available supporting evidence: Strong; Moderate; Limited; Expert Opinion Only; Grade not assignable For additional information regarding how to interpret grades, click here.

Evidence Summary Overview

Based on the literature dating back to November 1994, one randomized control trial (RCT) (Flechtner-Mors et al, 2004) and seven prospective observational studies directly addressed the question of alcohol consumption and weight gain. One RCT received a neutral rating. Of the seven prospective observational studies, three received positive ratings and four received neutral ratings. Flechtner-Mors 2004 concluded that an energy-restricted diet is effective in losing weight regardless if 10% of energy is derived from white wine or grape juice. Of the prospective studies, Liu et al, 1994 suggests that alcohol intake is not a risk factor for obesity. Drinkers were less likely to have either major weight gain or weight loss than non-drinkers. Sherwood et al, 2000 and Sammel et al, 2003 found similar results that indicated alcohol consumption was not associated with substantial weight gain. While light to moderate drinking appeared to show no significant (NS) increase in weight, heavy drinking was shown to increase weight (Wannamethee and Sharper 2003; Wannamethee et al, 2004). However, Wannameethee 2004 found that light drinking was associated with increased odds of weight gain in African American women. Two studies (Koh-Banerjee et al, 2003 and Tolstrup et al, 2008) looked at changes in waist circumference. Koh-Banerjee found no significant association in total alcohol consumption and nine-year waist gain while Tolstrup found drinking frequency inversely associated with major waist gain and unassociated with major waist loss.

Evidence Summary Paragraphs

Randomized Control Trial

Flechtner-Mors et al, 2004 (neutral quality). This study was an RCT conducted in Germany, as part of a three-month isocaloric weight loss trial, that examined whether daily consumption of 10% of energy from either white wine or grape juice influenced the effectiveness of an energy-restricted diet in overweight and obese subjects. Forty subjects, men and women older than 18 years with body mass index (BMI) between 25.0 and 40.0kg/m^2, completed the study. They were recruited from an Obesity Center at an outpatient clinic of a University Hospital. The subjects regularly consumed 20 to 30g of alcohol per day. The subjects were randomly assigned to one of two dietary treatment groups, a white wine (WW) group (10% of total energy derived from white wine) and a grape juice (GJ) group (10% of total energy derived from grape juice). Participants consumed a 1,500kcal per day diet (15% protein, 30% to 35% fat and 50% to 55% carbohydrates or 45% to 50% carbohydrates and 10% of energy from white wine or grape juice). All subjects achieved significant body weight

loss. Weight loss in the GJ group and WW group was 3.75+0.46 and 4.73+0.53kg, respectively, and the difference was NS. The authors concluded that a diet with 10% of energy from white wine is as effective as an isocaloric 1,500kcal diet with 10% of energy derived from grape juice in achieving weight loss in overweight and obese subjects.

Prospective Observational Studies

Koh-Banerjee et al, 2003 (positive quality). In this prospective cohort study conducted in the US, the authors examined the association of changes in dietary intake, physical activity, alcohol consumption and smoking in a nine-year gain in waist circumference (WC) among a cohort of 16,587 men aged 40 to 75 years at baseline in 1986. The participants were part of the Health Professionals Follow-up Study. In 1986, participants completed a questionnaire regarding medical history, diet and physical activity. They self-reported their age, height, weight, smoking status and history, marital status and family history of coronary heart disease (CHD) and cancer. Biennially, participants completed a new questionnaire updating their information. Body mass index was calculated at each follow-up interval using participants' self-reported height and weight. In 1987 and 1996, participants self-reported their waist and hip circumferences. Over the nine-year follow-up period, the mean (+SD) WC increased 3.3+6.2cm, from 93.8+8.5cm in 1987 to 97.2+9.9cm in 1996. Alcohol consumption remained fairly constant over time, at an overall average of approximately 11.5±14.9g per day. Authors found NS associations between changes in total alcohol consumption and nine-year waist gain.

Liu et al 1994 (neutral quality). This study was a prospective study conducted in the US to examine the relationship between alcohol intake and body weight in 7,320 adults aged 25 to 74 who participated in the First National Health and Nutrition Examination Survey (NHANES) (1971 to 1975) and who were reweighed 10 years later (1982 to 1984). Alcohol intake was assessed during baseline interviews. Information on alcohol consumption (drinks per day) was obtained by responses to quantity-frequency questions during the medical history interview. Participants were categorized into six groups: Non-drinkers (did not drink during the past year), infrequent drinkers (less than 12 drinks a year), very light drinkers (12 or more drinks a year, but less than one drink a week), light drinkers (one or more drinks per week, but less than one drink per day), moderate drinkers (one to 1.9 drinks per day) and heavy drinkers (more than two drinks per day). Analyses were adjusted for age, race, height, education, health status, smoking status, diet status,physical activity and total non-alcoholic caloric intake. Both men and women drinkers tended to gain less weight than did non-drinkers (P=0.006 for trend in women, P=0.11 for trend in men). Drinkers also had more stable weight over the 10-year follow-up period. Drinkers were less likely to have major weight gain or loss (gaining or losing more than 10kg) than were non-drinkers. Compared with non-drinkers, those who consumed one to 6.9 drinks per week, women had an odds ratio (OR) = 0.7 (95% CI: 0.5 to 0.9) for major weight gain and an OR=0.7 (95% CI: 0.5 to 1.1) for major weight loss, while men had an OR=1.0 (95% CI: 0.6 to 1.6) for major weight gain and an OR=0.7 (95% CI: 0.5 to 1.2) for major weight loss. For those who consumed more than two drinks per day, women had an OR=0.5 (95% CI: 0.3 to 1.0) for major weight gain and an OR=0.8 (95% CI: 0.4 to 1.6) for major weight loss, while men had an OR=0.9 (95% CI: 0.5 to 1.6) for major weight gain and an OR=1.0 (95% CI: 0.6 to 1.7) for major weight loss. These results suggest that moderate alcohol intake is not a risk factor for obesity.

Sammel et al, 2003 (neutral quality). In a prospective study, 336 African American and Caucasian women were followed for four years regarding predictors of weight among women in their late reproductive years. Baseline measures included anthropometric variables, socio-demographic factors, measures of anxiety, depressed mood, quality of life and self-reported measures of diet, vigorous physical activity, alcohol consumption and cigarette smoking. Over 25% of the cohort

gained ten or more pounds during the follow-up. Among the women who gained more than ten pounds over the four-year period, the average alcohol consumption at baseline was 7.3 (±15.2) drinks per week. Among the remaining women who were more weight stable, baseline alcohol consumption was 8.5 (±19.0) drinks per week. The difference was still not statistically significantly different after multivariate adjustment for the main predictors of weight in this cohort of women.

Sherwood et al, 2000 (positive quality). In this prospective study of community volunteers, 826 women and 218 men who were participants in the Pound of Prevention study were followed over three years. Participants reported their usual serving size and frequency of consumption over the last year for 60 separate food items at baseline. Analyses also included baseline demographic information, smoking, physical activity and a behavioral eating score. At baseline, the average age was 35 in both men and women and the baseline BMI was 28.0kg/m^2 and 26.8kg/m^2 respectively. During the three years of follow-up, the average weight gain was 1.69kg (±5.4kg) among men and 1.76kg (±6.7kg) among women. During the same time period the average caloric consumption decreased by 211kcal per day among men and 168kcal per day among women, with a corresponding increase in percent of calories from alcohol by 0.88% and 0.30%, respectively. In prospective analyses, change in energy from alcohol was not associated with weight change in the men or women. Among participants who were in one of three groups: 1) Lost weight; 2) Maintained weight; or 3) Gained weight over the three years, there was NS difference in their average change in alcohol consumption. Although other diet and energy expenditure measures were associated with weight change in thiscohort, alcohol consumption at baseline or changes during follow-up were not associated with weight change.

Tolstrup et al, 2008, (neutral quality), conducted a prospective cohort study in Denmark to test the hypothesis that drinking frequency is associated with subsequent changes in WC and development of abdominal obesity. A total of 43,543 male and female participants from the Diet, Cancer and Health study were included in the analysis. Drinking frequency was not associated with major waist loss, but was inversely associated with major waist gain, suggesting that non-drinkers and the most rare drinker had the highest odds for major gain in WC. Odds ratios for major waist gain among men were 0.97 (95% CI: 0.73, 1.28) for never drinking, 0.95 (95% CI: 0.81, 1.12) for drinking on one day of the week, 0.88 (95% CI: 0.77, 0.99) for drinking on two to four days of the week, 0.82 (95% CI: 0.71, -0.95) for drinking on five to six days of the week, and 0.79 (95% CI: 0.69, 0.9) for drinking every day of the week, compared to men who drank alcohol on less than one day per week ($P<0.0001$). Results for women were similar, and adjustment for amount of alcohol intake or total energy intake did not affect results. The authors concluded that drinking frequency was inversely associated with major waist gain and was unassociated with major waist loss.

Wannamethee and Shaper, 2003 (neutral quality), a prospective cohort study, examined the relationship between alcohol intake and body weight, and the association between changes in alcohol intake and body weight over five years of follow-up in 6,832 middle-aged male participants of the British Regional Heart Study. After adjustment for potential confounding variables, meanBMI and the prevalence of men with BMI higher than 28kg/m^2 was not different between men who stayed as abstainers or light drinkers when compared with men who were moderate drinkers or those who became moderate drinkers. After five years of follow-up, stable heavy drinkers or men who became heavy drinkers (more than 30g per day of alcohol consumption) showed the greatest weight gain and had the highest prevalence rates of high BMI.

Wannamethee et al, 2004 (positive quality) conducted a prospective cohort study in the US to examine the relationship between alcohol and eight-year weight gain in 49,324 female registered nurses between the ages of 27 to 44 years from the Nurses' Health Study II. Women completed a validated 116-item food frequency questionnaire (FFQ) in 1991 and self-reported weights both in

1991 and 1999. A non-linear relationship was seen between alcohol and weight gain of 5kg or more. Compared with non-drinkers, the adjusted relative odds of weight gain according to grams per day were 0.94 (95% CI: 0.89, 0.99) for those consuming 0.1 to 4.9g per day, 0.92 (95% CI: 0.85, 0.99) for those consuming five to 14.9g per day, 0.86 (95% CI: 0.76, 0.78) for those consuming 15 to 29.9g per day and 1.07 (95% CI: 0.89, 1.28) for those consuming 30g or more per day (P<0.0001). The increased odds of weight gain associated with heavy drinking (30+ grams per day) were most marked in women under age 35 (OR=1.64; 95% CI: 1.03, 2.61). However, in the less than 3% of women who were African-American, light drinking was associated with increased odds of weight gain (OR=2.43, 95% CI: 1.22, 4.82).

View table in new window

Author, Year, Study Design, Class, Rating	Populations/Subjects	Significant Outcomes
Flechtner-Mors M, Biesalski HK et al, 2004 Study Design: Randomized Controlled Trial Class: A Rating:	N=40 overweight or obese middle-aged men and women. Three-month 1,500kcal weight loss intervention with daily self-monitoring. Mean age: 48.1±11.4 years. Mean BMI: 34.2±6.4kg/m^2. Location: Germany.	All subjects achieved significant body weight loss. Weight loss in the GJ group and WW group was 3.75±0.46 and 4.73±0.53kg, respectively, but the difference NS.
Koh-Banerjee P, Chu NF et al, 2003 Study Design: Prospective Cohort Study Class: B Rating:	N=16,587 healthy male health professionals without CVD, cancer or diabetes. Age: 40 to 75 years. Follow-up rate: 65%. Nine-year follow-up. Location: United States.	Alcohol consumption remained fairly constant over time, at an overall average of ~11.5+14.9g per day. NS associations observed between Δ in total alcohol consumption and nine-year waist gain. Alcohol and WC were self-reported.
Liu S, Serdula MK et al, 1994 Study Design: Cross-Sectional	N=7,320 adults who participated in the First NHANES. Reweighed in 10-year	Little relation observed between body weight and alcohol intake among men. Both men and women drinkers tended to gain less weight than did non-drinkers.

Study Class: D Rating:	follow-up. Location: United States.	Drinkers also had more stable weight over the 10-year follow-up period. Drinkers less likely to have major weight gain or loss (gaining or losing >10kg) than were non-drinkers. Compared with non-drinkers, those who consumed one to 6.9 drinks per week, women had an OR = 0.7 for major weight gain and an OR=0.7 for major weight loss, while men had an OR=1.0 for major weight gain and an OR=0.7 for major weight loss. For those who consumed >two drinks per day, women had an OR=0.5 for major weight gain and an OR=0.8 for major weight loss, while men had an OR=0.9 (for major weight gain) and an OR=1.0 for major weight loss. Results suggest that alcohol intake is not a risk factor for obesity. Drinkers less likely to have either major weight gain or weight loss than non-drinkers.
Sammel MD, Grisso JA et al, 2003 Study Design: Prospective Cohort Study Class: B Rating:	N=336 African American and Caucasian American women who participated in the Penn Study of Ovarian Aging over a four-year period. Location: United States.	Alcohol consumption among subjects did not affect risk of substantial weight gain. Subjects who gained ≥10 lbs drank an average of 7.3 drinks per week SD±15.2. Those who did not gain ≥10 lbs drank an average of 8.5 drinks per week SD±19.0. P=0.784.
Sherwood NE, Jeffery RW et al, 2000 Study Design: Prospective study Class: B	N=826 women and 218 men taking part in a weight gain prevention project over a three-year period. Location: United States.	No statistically significant findings between alcohol consumption and weight gain. Multivariate associations between weight and exercise and dietary intake patterns over three years in men (m) and women (w): Energy from alcohol (%): Coefficient 0.088 (m), 0.011 (w); standard error 0.056 (m), 0.034 (w); P value 0.116 (m), 0.734 (w).

Rating: 		Mean (standard error) Δ in dietary intake and physical activity between baseline and year three by weight gain status in men (m) and women (w): Energy from alcohol (%): By weight losers +0.1 (0.8) (m), +0.1 (0.3) (w) By weight maintainers +1.4 (0.5) (m), +0.1 (0.2) (w) By weight gainers +0.5 (0.4) (m), +0.4 (0.2) (w). P-value for men was 0.218 and 0.367 for women.
Tolstrup et al 2008 Study Design: Prospective Cohort Study Class: B Rating: 	N=43,543 male and female participants from the Diet, Cancer and Health Study. Baseline alcohol intake related to five-year waist Δ. Location: Denmark.	Results do not imply that regular alcohol intake is involved in development of abdominal obesity. Observed that drinking frequency was inversely associated with waist gain, suggesting that the most frequent drinkers had lowest odds for a positive change in WC during the follow-up period of ~five years. Finding independent of smoking status, absolute value of WC at baseline, preferred beverage type and amount of alcohol intake. Drinking frequency inversely associated with Δ in WC in women (P for linear trend <0.0001) and was unassociated with Δ in WC in men (P for linear trend = 0.15). Drinking frequency unassociated with major waist loss, but was inversely associated with major waist gain: OR among men were (drinking days per week) compared with men who drank alcohol 0.97 (95% CI: 0.73 to 1.28) never drinking 0.95 (95% CI: 0.81 to 1.12) one day 0.88 (95% CI: 0.77 to 0.99) two to four days 0.82 (95% CI: 0.71 to -0.95) five to six days 0.79 (95% CI: 0.69 to 0.9) seven days. Results for women were similar (P<0.0001).

Wannamethee and Shaper 2003 Study Design: Prospective Cohort Study Class: B Rating:	N-6,832 middle-aged male participants of the British Regional Heart Study. Five-year follow-up. Location: United Kingdom.	After adjustment for potential confounding variables, mean BMI and prevalence of men with BMI >28kg/m^2 ↑ significantly from light-moderate to very heavy alcohol intake group. Similar patterns seen for all types and combinations of alcohol. After five years, stable and new heavy drinkers (>30g per day of alcohol consumption) showed greatest weight gain and had highest prevalence rates of ↑ BMI.
Wannamethee et al 2004 Study Design: Prospective cohort study Class: B Rating:	N=49,324 female RNs from the Nurses' Health Study II who reported weight in 1991 and 1999. No history of CVD, cancer, diabetes or recent pregnancy. Mean age: ~38 years. Eight-year follow-up. Location: United States.	A non-linear relationship seen between alcohol and weight gain of >5kg in all women. Compared with non-drinkers, adjusted relative odds of weight gain according to g per day consumption were: 0.94 (95% CI: 0.89, 0.99) for 0.1 to 4.9g 0.92 (95% CI: 0.85, 0.99) for five to 14.9g 0.86 (95% CI: 0.76, 0.78) for 15 to 29.9g 1.07 (95% CI: 0.89, 1.28) for ≥30g (P< 0.0001). ↑ odds of weight gain associated with heavy drinking (≥30g per day) most marked in women <35 years of age (OR=1.64; 95% CI: 1.03, 2.61). However, in African-American women, light drinking associated with ↑ odds of weight gain (OR=2.43, 95% CI: 1.22, 4.82).

Research Design and Implementation Rating Summary
For a summary of the Research Design and Implementation Rating results, click here.

Worksheets

Flechtner-Mors M, Biesalski HK, Jenkinson CP, Adler G, Ditschuneit HH. Effects of moderate consumption of white wine on weight loss in overweight and obese subjects. *Int J Obes Relat Metab Disord*. 2004 Nov; 28 (11): 1,420-1,426.

Koh-Banerjee P, Chu NF, Spiegelman D, Rosner B, Colditz G, Willett W, Rimm E. (2003).

Prospective study of the association of changes in dietary intake, physical activity, alcohol consumption and smoking with nine-year gain in waist circumference among 16,587 US men. *American Journal of Clinical Nutrition*, 78, 719-727.

Liu S, Serdula MK, Williamson DF, Mokdad AH, Byers T. A prospective study of alcohol intake and change in body weight among US adults. *Am J Epidemiol.* 1994 Nov 15; 140(10): 912-920.

Sammel MD, Grisso JA, Freeman EW, Hollander L, Liu L, Liu S, Nelson DB, Battistini M. Weight gain among women in the late reproductive years. *Family Practice.* 2003; 20: 401-409.

Sherwood NE, Jeffery RW, French SA,Hannan PJ and Murray DM. Predictors of weight gain in the Pound of Prevention study. *Int J Obes Relat Metab Disord*. 2000; 395-403.

Tolstrup JS, Halkjaer J, Heitmann BL, Tjonneland AM, Overvad K, Sorensen TI, Gronbaek MN. Alcohol drinking frequency in relation to subsequent changes in waist circumference. *Am J Clin Nutr*. 2008; 957-63.

Wannamethee SG, Shaper AG. Alcohol, body weight, and weight gain in middle-aged men. *Am J Clin Nutr*. 2003 May; 1312-7.

Wannamethee SG, Field AE, Colditz GA, Rimm EB. Alcohol intake and 8-year weight gain in women: a prospective study. *Obes Res.* 2004 Sep;12(9):1386-96.